REMARKS/ARGUMENTS

In the present invention, at least two different patterns, a data pattern and a finder pattern, are encoded into a binary matrix of data cells presenting a two-dimensional symbol where one pattern is represented by a single color and the other pattern is represented by a different color. In addition, because the finder pattern is created using a different color, it may occupy the same space as the data pattern and be co-extensive therewith, thereby increasing data density without increasing image overhead. In this format, each binary digit "0" or "1" is represented by a single data cell representing either a relatively dark or relatively light color, depending upon the color light or filter used to view the symbol.

The Office Action rejected claims 1-29 under 35 U.S.C. 102 as being anticipated by Cass et al. (US 5,946,414). However, Cass fails to teach every element of the claimed invention. Specifically, Cass fails to teach or suggest the use of two simultaneous patterns, i.e., a "finder pattern" and a "data pattern", as recited in independent claims 1, 17 and 23. The Office Action treats as equal, phrases from Cass and the present invention that refer to very different concepts and methods.

Independent Claims 1, 17, and 23:

As explained fully in Cass, the message data 20 (denoted in Fig. 1 as m) to which the office action refers is simply that, data, not an image or pattern. The only image or pattern that is formed in Cass is message image 70, M, which is created from the message data 20, m. The message image 70, M, is comprised of uniquely patterned signal blocks or sub-regions. (See Operation 200, Cass, col. 13, lines 45-57). The message image 70, M, is then combined with a carrier image 40 by operation 300. This combination modulates the colors in the signal blocks according to respective colors in the carrier image. This modulation of colors results in image 80, E, including the encoded message. (See Operation 300, Cass, col. 13, line 67-col. 14, line 7). Thus, where the present invention uses two distinct colors to define two separate patterns, i.e., a data pattern and a

finder pattern, Cass uses modulated colors to define a single pattern, i.e., the message image 70, M, in a final image 80, E.

Further distinguishing the present invention, Cass discloses encoding data in color images using patterned color modulated image regions. In Cass, each binary digit "0" or "1" is represented by a two color spatial pattern, with one pattern representing a "0" and a different pattern representing "1". (see Cass fig.4) In the particular patterns illustrated in figure 4, a "0" is represented by four cells, in which the dark cells form a "back slash" glyph and the "1" is represented by four cells, in which the dark cells form a "forward slash". In Cass, the data is encoded by the glyph pattern and not by the color. The use of a glyph to represent each binary digit instead of the use of a color results in a spatial expansion because all of the glyph patterns require multiple cells and at least two colors to draw them. In Cass the use of color is only intended to render the symbol less noticeable to the eye, which is a central purpose of the invention in Cass. (Cass col.1, lines 28-39; col.6, lines 61-66.) To this end, the glyphs are printed small and the pair of colors used to print the glyph is chosen such that the eye will blend them together and perceive the mean color rather than the glyph pattern.

Referring to Cass Figs. 8 & 9, the concept of "color modulation" is illustrated. In these figures it is shown that the two colors used to print each glyph are chosen as deltas in color space from some local background color. The deltas of the two colors are of equal magnitude but opposite in direction so that when the eye blends the colors the mean color will be perceived. Because in Cass the data is encoded by glyphs and not by color, the individual glyph patterns may be printed with respect to any mean color and each glyph pattern is used as a "dot" as part of a lower spatial resolution "picture". The use of the glyph patterns as dots in printing a lower resolution picture is the only way in which the message image M can be combined with the carrier image in Cass. This type of embedding of the data in a picture is feasible with Cass precisely because the data coding is not based on the color of data cells.

In contrast to Cass, in the present invention one or more messages are presented in a single two-dimensional array of color cells, wherein each individual color cell may contain multiplexed information from one or more messages or finder patterns. The colors of the cells are chosen to allow the multiplexed data to be separately accessible by subjecting the code to a series of color filters, one color filter for each separate message stream. Unlike Cass, the present invention uses color to encode the multiplexed information. This results in a reduction of the spatial requirements for the symbol. Cass's method has the opposite effect requiring multiple cells, i.e., glyphs of modulated color spatial patterns, to represent a single bit of information. The two-dimensional array of color cells in the present invention carries the data content of one or more complete messages and/or finder patterns.

The two-dimensional "uniquely patterned" signal block patterns described in Cass (col.13, lines 45+) refer to the formation of glyphs representing single bits of information. The term "color cell" as used by Cass does not refer to anything which can of itself carry a full bit of information. Instead, the color cells are a sub-component of a glyph (signal block pattern) which is small enough not to be separately perceived by a human observer. (see Cass col.14, lines 56+; col.15, lines 1+) Therefore, Cass's color cells cannot be assigned a value of "0" or "1" and do not correspond in any way to the "data cells" claimed in the present invention. Cass does not disclose any method whereby multiple messages or finder patterns may be encoded such that they become separately discernable, in turn, by being subjected to a series of color filters. Because Cass encodes data bits as a spatial arrangement using glyphs (signal block patterns) instead of color multiplexing, subjecting the Cass symbol to color filters cannot be used to separate multiplexed data.

Cass does not disclose a method to multiplex a finder pattern in the same space as the data. In fact, Cass discloses no finder pattern at all. The total lack of a finder pattern results in a very inefficient location and orientation process. The location and orientation process as described by Cass is: "In general this is

accomplished by analyzing all possible phase shifts of the signal grid to find one with the smallest number of invalid signal blocks." (Cass et al. col.29, line 63+; and Figs. 44, 45, & 46.). Color 83/663 and color 84/660 cannot be reasonably equated with color filters or color illumination sources. As clearly illustrated in Cass, Fig.8, color 83 and color 84 are the two print colors used to form the glyph and are chosen such that when blended together by the eye the mean color c1 is perceived. The discussion at the reference (Cass col.27, lines 47+) is not related to color filters or illumination sources. Rather, it explains that if the glyph patterns are formed with four colors instead of only two, each glyph can represent one of four values instead of being limited to the binary case. Further, it is explained that if four values are used the ±delta pairs should be chosen in orthogonal directions in color space to maintain the tendency for the eye to continue to blend them to the mean color.

Accordingly, Cass fails to show or suggest the present invention as recited in claims 1, 17 and 23. Namely, Cass fails to teach or suggest the use of two simultaneous patterns, i.e., a "finder pattern" and a "data pattern", the use of color coded "data cells" to convey "a data pattern value, a finder pattern value, or an overlapping data pattern value and finder pattern value".

Claims 2 and 24:

Cass fails to show, teach or suggest the use of color filters or color illumination sources. It is unreasonable to interpret color 83/662 as relating to either a color filter or a color illumination source. As explained above, the colors in Cass are modulations of the local mean color and represent print colors used in the glyphs. (see Cass Figs. 8, 12, & 26) Referring to figure 8 particularly, notice that 83 is identified as the mean color plus or minus a delta. Color 83 is one of the two print colors used to print the data pattern. The four cells of the pattern together represent one bit of information and are printed using two colors. The colors are selected such that sum of the two colors is perceived by the eye to be the mean color. Interpreting "color 83/662" as a first color illumination source is not supported by the text or figures, and would not result in

a usable system. Exposing the pattern depicted in figure 8 to a series of color filters or to a series of color illumination sources would not reveal separate overlapping message and finder pattern bit states because there are none. Cass encodes data in spatial glyph patterns. The four cells taken together only represent a single data bit. Furthermore, because encoding the data in glyphs is independent of specific print colors, the neighboring glyphs may be printed as modulations of entirely different colors. Exposing the image E in Cass to a series of color filters or color illumination sources would not reveal a pattern, let alone any additional meaningful information.

Claims 3 and 25:

Cass fails to teach or suggest the use of color filters or color illumination sources. As explained above, just as it is unreasonable to interpret color 83/662 as relating to either a color filter or a color illumination source, it is similarly unreasonable to interpret color 84/660 in Cass as relating to either a color filter or color illumination source. Color 84/660 simply refers to one of the print colors selected for the glyph image such that the eye perceives a color mean. (see Fig. 8).

Claims 4-5:

Cass fails to teach or suggest the use of color filters. Nowhere does Cass mention or imply the use of color filters. Cass discusses the selection of print colors for use in output signal blocks such that the difference is minimized for human viewers and maximized for the response of the scanner. (Cass, col. 10, lines 1-62; col 17, lines 10-20; and col. 18, lines 1-37). Typical sensors such as CCD cameras have color sensitivity profiles different from the human eye. Moreover, unlike the present invention, where exposure to a series of color filters reveals separate data patterns and/or finder patterns, in Cass the message data is encoded as glyphs. Therefore, viewing Cass's symbol through a color filter would not reveal alternate patterns. Neither would exposure to color filters reveal anything of a global nature about the single encoded message.

Claims 6-7:

Cass fails to teach or suggest the use of color filter means. Cass does not disclose any system or method which utilizes color filters to process the symbol image. In the present invention, the first color filter means and the second color filter means are color filters applied sequentially to reveal, in turn, separate data patterns and/or finder patterns. There is nothing in Cass which is even remotely suggests the use of color filters – for this purpose or any other. There is no mention of a single color filter in Cass, let alone a first and second. Instead, the tedious process of decoding the message is described. In particular, the "signal block" patterns are recovered not by applying color filters sequentially to reveal them, but instead the pattern is extracted by subtracting the local mean color. Fig. 42 shows a block diagram of the encoding operation. (Cass, col.26, line 64+). The encoding operation does not make reference to color filters and it pertains to encoding not to processing the symbol image.

Claims 8 and 26:

Cass fails to teach or suggest a symbol wherein the data cells are arranged in a rectilinear matrix. The citation to Cass in the office action refers to the arrangement of color cells within the signal block or glyph. Cass explains that the glyphs can be made using other shapes besides just the "back slash" and "forward slash" depicted in Cass, Fig.8. (Cass, col. 19, line 30 – col. 23, line 33; Figs. 15-24). The color cells of Cass do not correspond to the data cells in the present invention. The color cells in Cass are sub-regions of the signal blocks. Therefore, the citation to Cass is unrelated to what the present invention refers to and claims as a rectilinear data field.

Claims 9-10, 19:

Cass fails to teach or disclose the use of visible versus invisible light spectra. The colors in Cass are dictated by the background color which is modulated to allow the printing of tiny glyph patterns without being discernible by the human observer. The mean color is visible to a human observer, but the variations in color from the mean that create the glyph patterns are not

discernible. Cass does not teach or suggest the use of anything related to the invisible light spectrum. The portion of Cass cited in the office action discusses increasing the spatial frequencies of the differently colored sub-regions or constant color within a signal block, i.e., increasing the number of sub-regions in a signal block. (Cass, col. 25, lines 38-53; compare Fig. 40 to Fig. 2). Spatial frequency refers to the limited ability of the human eye to pick out individual colors when there are a lot of them printed very close together (i.e increased spatial frequency).

In the present invention, the visible or invisible light spectrum refers to the wavelength range of the radiation in which the data cells are visible. For example, the data cells may be printed with ink which is only visible when illuminated with ultra-violet or infrared light. Cass fails to discuss the wavelength frequency of light needed to view the printed glyphs. These are entirely unrelated matters.

Claims 12-13, 18:

Cass fails to teach or suggest assigning a color to a data cell corresponding to an overlapping data pattern value and finder pattern value. As has been explained above, Cass does not teach the use of separate data patterns and finder patterns. Therefore, it cannot teach about assigning a color to a data cell corresponding to an overlapping data pattern and finder pattern value. Further, Cass does not assign colors corresponding to data patterns values. In Cass, data information is encoded in glyphs (signal blocks) and the colors are selected as modulations of the background color existing in the carrier image. The mean color for each glyph block is determined by the mean color value of the background within the area occupied by the glyph. While Cass states that "the encoded signal blocks can be viewed as forming a grid that is superimposed over the original color image," that is merely a convenient method of describing the process. The region of the carrier image that bears the encoded signal blocks has been rewritten and the original portion of the carrier image is not longer available. In contrast, the present invention specifically

teaches and claims that the overlapping data pattern and finder pattern values are readily discernible.

Claims 14-15, 21:

Cass fails to teach or suggest assigning a color to a data cell corresponding to multiple data pattern values. There is nothing in the references (nor anywhere else in Cass's disclosure) that teaches assigning a data cell a color corresponding to multiple data pattern values. Cass uses glyphs not color to encode message data. Instead, all of the colors in Cass are assigned as modulations of the local background color to reveal the glyph pattern. The data message in Cass is encoded in the glyph patterns, with each glyph representing a "0" or a "1" in binary code. There is no description in Cass to support the office actions statement that multiple data pattern values are encoded in a single glyph. If a glyph represents a "0" in one data pattern, it will represent a "0" in another data pattern as well.

Claims 16, 22, and 27-28:

Cass fails to teach or suggest assigning a binary value to each data cell corresponding to a data pattern or a finder pattern value. As discussed above, Cass does not teach or suggest a finder pattern in addition to a data pattern. Further, unlike the present invention, Cass does not assign input values (binary or otherwise) to individual data cells. Rather for each input value a pattern of color cells is created to form the signal block or glyph.

Claim 20:

Cass fails to teach or suggest that a subplurality of the data cells is assigned a color corresponding to a finder pattern value and multiple data pattern values. As discussed above, Cass does not teach or suggest a finder pattern in addition to a data pattern. It instead describes a very tedious process to locate and orient the encoded data (Cass, col.29, line 63+; and Figs. 44, 45, & 46). Further, Cass does not assign colors to data cells to represent data. Instead it represents a single data bit or signal block as a two-dimensional pattern of color cells where each signal block pattern contains two colors which

are selected as variations by modulating the local mean color. In addition, Cass does not pack multiple data pattern values into a single cell. Instead it expands a single bit into multiple cells.

Claim 29:

Cass fails to teach or suggest including means for determining the location of symbol damage using a color filter. The portion of Cass cited in the office action does not discuss determining the location of symbol damage using a color filter. Instead the cited portion of Cass describes the process of attempting to locate a symbol which has no finder pattern. The filter mentioned in the reference is a "correlation filter" not a "color filter". A correlation filter gives large output values at locations where two images are aligned and at the same scale and lower output values in other conditions.

Unlike Cass, the present invention allows for a maximally effective finder pattern and constrains the color arrangement such that only certain colors are valid at certain locations within the symbol. Symbol damage is unlikely to change a cell from one valid color for a given location to another valid color for that same location. Therefore, by using a color filter the location of damaged parts of the symbol are readily revealed.

CONCLUSION

Applicant submits that the claims as presented comprise allowable subject matter. Accordingly, claims 1-29 are in condition for allowance, notice of which is respectfully requested.

Respectfully submitted,

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